

## Characteristics Shared by the Scientific Electronic Journals of Latin America and the Caribbean

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### Abstract

Our objective is to analyze the use that Latin American peer-reviewed journals make of the tools and opportunities provided by electronic publishing, particularly of those that would make them evolve to be more than “mere photocopies” of their printed counterparts. While doing these, we also set out to discover if there were any Latin American journals that use these technologies in an effective way, comparable to the most innovative journals in existence. We extracted a sample of 125 journals from the LATINDEX – Regional System of Scientific Journals of Latin America, the Caribbean, Spain and Portugal – electronic resources index, and compared along five dimensions: (1) Non-linearity, (2) use of multimedia, (3) linking to external resources (“multiple use”), (4) interactivity, and (5) use of metadata, search engines, and other added resources. We have found that very few articles in these journals (14%) used non-linear links to navigate between different sections of the article. Almost no journals (3%) featured multimedia contents. About one in every four articles (26%) published in the journals analyzed had their references or bibliographic items enriched by links that connected to the original documents quoted by the author. The most common form of interaction was user!journal, in the form of question forms (17% of journals) and new issue warnings (17% of journals). Some, however (5%) had user!user interaction, offering forums and response to published articles by the readership. About 35% of the journals have metadata within their pages, and 50% offer search engines to their users. One of the most pressing problems for these journals is the wrong use of rather simple technologies such as linking: 49% of the external resource links were mismarked in some way, with a full 24% being mismarked by spelling or layout mistakes. Latin American journals still present a number of serious limitations when using electronic resources and techniques, with text being overwhelmingly linear and underlinked, e-mail to the editors being the main means of contact, and multimedia as a scarce commodity. We selected a small sample of journals from other regions of the world, and found that they offer significantly more non-linearity ( $p = 0.005 < 0.1$ ), interactive features ( $p = 0.005 < 0.1$ ), use of multimedia ( $p = 0.04 < 0.1$ ) and linking to external documents ( $p = 0.007 < 0.1$ ). While these are the current characteristics of Latin American journals, a number of very notable exceptions speak volumes of the potential of these technologies to improve the quality of Latin American scholarly publishing.

**Keywords:** Electronic journals; scholarly journals; Latin America; serials quality criteria; LATINDEX

### 1. Introduction

Electronic journals in Latin America have been under-analyzed in terms of their architecture, particularly in how well they exploit the tools made available by Internet technologies, which provide new ways to produce interaction with the readers, non-linearity in the text, and multimedia content to illustrate and complement the articles. If online journals take advantage of these novel tools, they can become more

than mere clones of their printed versions. This would give them an advantage that could potentially place them format-wise at par with the more innovative journals in the world, and can help in the debunking of some pervasive prejudices held by the entire scientific community towards electronic publishing [1]. We analyzed a sample of peer-reviewed journals from the Latin America and the Caribbean, and measured the adoption of those features in journals from across the region. We seek to diagnose the present situation in Latin America, but also to provide a basis for comparison with related journals in other longitudes of the world. Mayernik [2] published a study along this line, where he analyzed 11 psychology and 10 physics journals, but didn't make any emphasis on their geographical origin.

A number of virtual libraries, indexes and repositories have sprung forth in Latin America to support the work of the local journals, as well as to help them in better using their resources (particularly monetary resources) with proposals that can improve editorial quality, including introduction of open-source software in their work cycles and adoption of Open Access as a philosophy for the journals. All of these efforts are aimed to make this "hidden science" more accessible to the academic world in both the local and global spaces. The Regional System of Scientific Journals of Latin America, the Caribbean, Spain and Portugal – LATINDEX ([www.latindex.org](http://www.latindex.org)) – was created in 1997, and currently has a directory of more than 16000 journals. It also provides a criterion-reviewed "catalogue" with 2952 journals. These journals have been selected based on 36 evaluation criteria that describe basic editorial quality. Among these criteria, three aspects are aimed specifically at online journals: use of metadata, incorporation of a search engine for the content of the site, and inclusion of "added content", such as lists of "links of interest", discussion forums, etc. From the journals in the directory, 2490 have an electronic version.

Electronic journals have been at the center of a long-running discussion in the editorial word. Since 1997, Valuskas [3] defined electronic journals as "a digital periodical dedicated to publishing, on the Internet, articles, essays, and analyses that have been read and commented upon initially by a select group of editors and reviewers, to meet a certain arbitrary standard of excellence (as determined by the editors) for a given discipline addressed by the journal itself". In this sense, electronic journals were perceived in terms of their availability in the web. However, this definition leaves out any mention of the potential exploitation of Internet tools. Valuskas [3] complements the explanation by saying that "The very electronic nature of the journal provides ample opportunities for experimentation with formats, layouts, fonts, and other design features, although many electronic journals fail to jump at some obvious opportunities to make given issue more readable and appealing to the eye". One year later, Hitchcock et al. [4] drew attention onto the importance of links within the text, as well as other Internet-related advantages that could improve access to the knowledge contained in scientific journals.

Efforts have been made to clearly define the parameters upon which electronic journals could be evaluated. An important description deals with the relation the electronic journal might have with a potential printed counterpart. Kling & McKim [5] defined three possibilities for this relation: pure **e-journals** that were born electronic, **p-e journals** where the articles were first published on paper but where electronic distribution is also possible, and **e-p journals** where the electronic format is the predominant version, but limited quantities of paper versions are also produced. While the authors are very clear in pointing out that not all Internet-based journals are rigorous in their peer-review processes, they establish that the model of publication does not determine the quality of the final product.

Notwithstanding the way they got into the web, we assume as a matter of course that electronic journals must be peer-reviewed, must conform to international editorial standards (such as the LATINDEX criteria), and the majority of its text must be made of scientific articles. In keeping with this, for this study we will only use peer-reviewed journals, and not include any bulletins or science popularization magazines.

A few studies have scratched the surface of the electronic publishing practices in Latin America. Dias [6] studied a number of Brazilian journals for their use of hypertext and search engines as a satisfactory

implementation of the inherent possibilities of the electronic medium. Marcondes et.al. [7] wrote a descriptive study about Brazilian electronic journals, focusing on technical aspects such as electronic text formats used, availability of a site search engine, if the journal belonged or not to a portal, proving that metadata were little known by Brazilian editors, and that features such as interactivity, hypertext and multimedia were almost never used. They conclude that Brazilian journals resemble journals from other parts of the world, in that the issues are designed following the printed-only model, delivering the Internet version as a virtual photocopy of the document, in want of “more professionalism from the editors”. Another significant case in Latin America was presented in ELPUB 2006 by Muñoz, Bustos and Muñoz [8] where they studied the Chilean *Electronic Journal of Biotechnology*, and described the journal’s innovative features in terms of usability of the website, speed and efficiency, use of metadata, adoption of the DOI system, and use of CrossRef as a citation linking system.

Mayernik [2] wrote the most comprehensive study in this field. He used four specific dimensions to evaluate the journals: (1) non-linearity of the document (2) external links to the documents quoted in the article (be it the main body or the references), which he refers to as “multiple use”, (3) multimedia use in the articles or in the website, and (4) interactivity with the readers, in the form of forums or other two-way communications. (Mayernik also studied a fifth dimension, speedy publication, which we will not consider here). These characteristics are deemed as innovative in their use of the technical possibilities of the web, and as a valuable addition to the overall experience of the reader/user. However, as some authors have explained (Harnad [9], Tenopir & King [10]), these qualities are not fully exploited by the editors, and the journal’s full potential is not achieved. These four dimensions are anything but casual. Hitchcock et. al. [4] had denominated the emergency of hyperlinking as “the second frontier”. Harnad studied the benefits of hyperlinks as early as 1992 [11], and Lukesh [12] has explained how multimedia options “play a major role in the similar explosion we are undergoing today as they become tools in developing knowledge rather than simple illustrations”.

A number of repositories and virtual collections (such as the Brazilian SciELO and the Mexican REDALyC for example<sup>1</sup>), usually associated to universities, have played a significant role in pushing forward the digitalization of the scholarly journals in the region, particularly within the Open Access model. These solutions have emerged as a way to focus whatever resources become available and apply them to a number of journals at the same time, and have become valuable tools to provide visibility and web presence to the scientific production of Latin America, providing data on how this information is used and quoted within the local scientific community, and how a field of knowledge evolves in the region. In this study, however, we will focus on the specific website of each of the journals, and see what solutions are being used by individual journals and their editorial boards.

We will try to determine how “innovative” are electronic journals in Latin America, where innovation is understood as the exploitation and application of Internet resources, tools and programs that can improve the user!journal and user!user communication processes, and add competitive value to the journal. We understand that the web offers these possibilities, but that they are not taken advantage of by Latin American editors, and indeed by editors around the world (Harnad [9], Tenopir & King [10]).

Our first objective is to analyze the e-journals in Latin America, to **(a)** determine the degree in which they are copies of their printed counterparts, and **(b)** to discover the specific Internet tools and resources that editors are using to improve their journals. Our second objective is to determine how these journals fare when compared to e-journals from other parts of the world that can be regarded as innovative and technically advanced.

## 2. Methodology

We selected peer-reviewed journals, with open access to their articles and at least 40% of scientific content,

and that are published independently, not as a part of a larger collection site (such as SciELO or REDALyC) that might have made caused their content to artificially conform to different publishing standards. Based on the Mayernik [2] characteristics, we chose to study: (1) *Non-linearity*, the ability to jump from one part of the article to the other as the user wishes, (2) *multimedia*, the use of audio or video to enhance the user's experience, (3) *multiple use*: the existence of links to the full text of the documents quoted or referred to on the article, and (4) *interactivity*: the existence of tools that can provide interaction between the editors, the authors, and the readers of the journals. Mayernik described a fifth characteristic, *speedy publication*, but we will not consider it amongst the objective of our study.

Additionally, we also analyzed the use of criteria 34, 35 and 36 of the LATINDEX e-journal criteria: use of metadata, use of search engines, and use of "added value services", such as links to external resources, documents relevant to the readership, forms of interaction, etc <sup>2</sup>.

To evaluate the journals, we used the Electronic Resources Index of the LATINDEX website. We chose the 12 countries that have more than 10 journals in the directory: Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Mexico, Peru, Uruguay and Venezuela. Within these groups, we randomly chose 10% of the journals. While the original sample included 167 journals, it also included bulletins, non-peer-reviewed journals and science education magazines. After accounting for this we arrived at the final sample size of 125 journals (see Appendix 1), representative of the journals within Latindex' electronic directory with an estimated sampling error of 7.5%. The journals had in average  $8.95 \pm 5.8$  articles per issue, so we randomly chose one third of the articles (3 for every issue) to perform the analysis, arriving at a final sample of 375 articles. The multimedia, interaction and LATINDEX-34-35-36 criteria were evaluated at the journal level (using the 125 journals as the sample), and the non-linearity and multiple use criteria were evaluated at the article level (using the 375 articles as the sample).

For the LATINDEX criteria, a journal scores one point if it meets all criteria, 0.66 if it meets 2 criteria, and 0 if neither metadata, search engines or added services are present. For the multimedia criteria, there are two individual criteria: (1) presence of video features and (2) presence of audio features. The presence of one of these is interpreted as one point. The presence of only one feature is 0.5 points. The non-existence of these features awards the journal zero points. For interaction, the four criteria are: (1) presence of a contact form that a user can use to write to the editors, (2) presence of some means of communication between the reader and the author, or some expert in the field, (3) presence of some means of communication amongst the readers, and (4) use of alert features, such as e-mail subscriptions or RSS news feeds. A journal scores one point if it meets all criteria, 0.75 if it meets 3 criteria, 0.5 if it meets only two, 0.25 if it meets just one, and 0 for no compliance of any criterion.

In addition to the whole-corpus counts, we also analyzed the corpus of journals and articles along two variables: country of the journal, and subject (Social Sciences, Medical Sciences, Agricultural Sciences, Exact and Natural Sciences, Multidisciplinary, Arts and Humanities, and Engineering).

Finally, we chose a small intentional sample of e-journals from other regions of the world that made extensive use of our studied characteristics, and compared them against a selection of journals chosen as "top in their class" by three LATINDEX officials<sup>3</sup>. We evaluated the non Latin American journals using the same parameters as the Latin American ones, and proceeded to compare them.

Our research design is exploratory, representative of a major collection of Latin American peer-reviewed journals. This paper being of an exploratory nature, we chose  $\alpha = 0.1$  for statistical comparisons.

We used Microsoft® Access© 2003 for database keeping, Adobe® Acrobat Reader© 8 for PDF analysis, and Internet Explorer© 6, Internet Explorer© 7, Mozilla® Firefox© 2.0 and Opera® 9.27 for Internet browsing within the Microsoft® Windows XP© Service Pack 2 operating system. We used the software JMP© 7 for statistical analysis.

### 3. Results

#### 3.1 General information about the corpus

We examined 125 journals from 12 different countries, using the most current issue as the point of reference to start the comparative analysis. In the following table, we describe the sample's age and use of computer formats:

| Year of publication of the current issue | Format of the articles in the latest edition |                   |                    |
|--|--|-------------------|--------------------|
| 2008                                     | 31 articles (25%)                            | PDF               | 312 articles (83%) |
| 2007                                     | 56 articles (45%)                            | HTML              | 102 articles (27%) |
| 2006                                     | 20 articles (16%)                            | Both PDF and HTML | 42 articles (11%)  |
| 2005                                     | 6 articles (5%)                              |                   |                    |
| Prior to 2005                            | 12 articles (9%)                             |                   |                    |

**Table 1. Age and format of the corpus**

#### 3.2 Non-linearity

We defined four possibilities for our intradocument links: (1) Navigational links to jump between sections of the document, (2) Links to footnotes or notes at the end of the document, (4) Navigational and footnote links combined and (4) Links to reference or bibliography items. Mayernik uses our possibility 3 as his measure for non-linearity.

|                          | Navigational links | Footnote links     | Navigational and footnote links combined | Links to references or bibliography |
|--------------------------|--------------------|--------------------|--|-------------------------------------|
| Articles that contained: | 20 articles (5.3%) | 33 articles (8.8%) | 51 articles (13.6%)                      | 14 articles (3.7%)                  |
| Average (links)          | 11.2 ± 11.8 links  | 16.4 ± 16.7 links  | 15.0 ± 15.2 links                        | 32.6 ± 28.9 links                   |

**Table 2. Non-linearity across the corpus.**

Given the large variability in the corpus, it is no surprise that the standard deviation is larger than the average in most categories. Only in the references section the variation is narrow enough to say that each article has at least 3 links to the bibliographic references. Table 3 describes the situation in more detail, breaking it down to the country level.

We compared how the use of HTML and PDF formats affected the use of internal links, and found that there is indeed a significant difference. When HTML format is used (alone or in combination with PDF), there is a significantly higher amount of internal links within the document, both navigational and to the references.

#### 3.3 Use of multimedia

We found that only 2.5% of the journals use audio resources; and only the 3% of them post videos on their website. In average, the use of multimedia in the journals analyzed equaled 0.03 points. There are no significant differences in the use of multimedia either by country or by subject.

#### 3.4 Multiple use

We subdivided the multiple use category in four different areas: (1) External links embedded in the body of the article, (2) external links in the reference or bibliography section, that lead directly to the text of the reference item, (3) external links in the reference or bibliography section, that might lead directly or

indirectly to the text of the reference item, where *indirectly* is understood as “three clicks away or less”, and (4) external links in the reference or bibliography section, that lead directly or indirectly to the text, or at the very least lead to an abstract of the reference item. Mayernik uses our area (2) as his measure for multiple use.

|              | Number of journals and average links |                          |                                    | Signification groups *   |                          |                                    |
|--------------|--------------------------------------|--------------------------|------------------------------------|--------------------------|--------------------------|------------------------------------|
|              | Navigational links                   | Footnote links           | Footnote and navigational combined | Navigational links       | Footnote links           | Footnote and navigational combined |
| <b>Total</b> | 20 (5.3%)<br>11.2 ± 11.8             | 33 (8.8%)<br>16.4 ± 16.7 | 51 (13.6%)<br>15.0 ± 15.2          |                          |                          |                                    |
| <b>ARG</b>   | 0                                    | 5 (10%)<br>16.8 ± 15.7   | 5 (10%)<br>16.8 ± 15.7             | C                        | B C D                    | C D                                |
| <b>BRA</b>   | 0                                    | 11 (16%)<br>16.5 ± 21.3  | 11 (16%)<br>16.5 ± 21.3            | C                        | B C                      | B C D                              |
| <b>CHL</b>   | 6 (17%)<br>18.5 ± 13.2               | 5 (14%)<br>13.8 ± 12.3   | 11 (31%)<br>16.4 ± 12.4            | A                        | B C D                    | A B                                |
| <b>COL</b>   | 3 (9%)<br>3.7 ± 2.1                  | 0                        | 3 (9%)<br>3.7 ± 2.1                | B C                      | D                        | D                                  |
| <b>CRI</b>   | 0                                    | 3 (17%)<br>24.7 ± 21.1   | 3 (17%)<br>24.7 ± 21.1             | B C                      | B                        | B C                                |
| <b>CUB</b>   | 5 (28%)<br>6 ± 4.8                   | 0                        | 5 (28%)<br>6 ± 4.8                 | A B                      | C D                      | B C D                              |
| <b>ECU</b>   | 0                                    | 0                        | 0                                  | B C                      | B C D                    | B C D                              |
| <b>MEX</b>   | 6 (7%)<br>12 ± 14.4                  | 2 (2%)<br>5.5 ± 6.4      | 6 (7%)<br>13.8 ± 13.4              | B C                      | D                        | D                                  |
| <b>PER</b>   | 0                                    | 0                        | 0                                  | B C                      | B C D                    | C D                                |
| <b>PRI</b>   | 0                                    | 2 (17%)<br>8.5 ± 2.1     | 2 (17%)<br>8.5 ± 2.1               | B C                      | B C D                    | B C D                              |
| <b>URY</b>   | 0                                    | 5 (42%)<br>21.2 ± 17.3   | 5 (42%)<br>21.2 ± 17.3             | B C                      | A                        | A                                  |
| <b>VEN</b>   | 0                                    | 0                        | 0                                  | B C                      | C D                      | D                                  |
|              |                                      |                          |                                    | <b>p = 0.01 &lt; 0.1</b> | <b>p = 0.04 &lt; 0.1</b> | <b>p = 0.01 &lt; 0.1</b>           |

**Table 3. Non-linearity by country.** (The first line in the left cells is “number of articles” and “percentage of articles in the corpus”. The second line is “average number of links” and “standard deviation in the number of links”).

|                          | Average links                      |                                     | Signification groups *             |                                     |
|--------------------------|------------------------------------|-------------------------------------|------------------------------------|-------------------------------------|
|                          | Footnote and navigational combined | Links to references or bibliography | Footnote and navigational combined | Links to references or bibliography |
| <b>Total</b>             | 11.2 ± 11.8                        | 16.4 ± 16.7                         |                                    |                                     |
| <b>Both HTML and PDF</b> | 6.0 ± 1.1                          | 5.1 ± 1.2                           | A                                  | A                                   |
| <b>Only HTML</b>         | 5.3 ± 0.9                          | 2.5 ± 1.0                           | A                                  | A                                   |
| <b>Only PDF</b>          | 0.7 ± 0.4                          | 0.3 ± 0.5                           | B                                  | B                                   |
|                          |                                    |                                     | <b>p &lt; 0.0001 &lt; 0.1</b>      | <b>p = 0.002 &lt; 0.1</b>           |

**Table 4: Formats used by the journals and their level for significance**

|                          | Originating from the body of the article | Originating from the references or bibliography |  |   |
|--------------------------|--|---|--|---|
|                          | External links                           | External links connecting directly to the item  | External links connecting indirectly to the item | External links connecting to the item or at least to its abstract |
| Articles that contained: | 51 articles (14%)                        | 82 articles (22%)                               | 98 articles (26%)                                | 98 articles (26%)   |
| Average (links)          | 7.4 ± 14.5 links                         | 3.4 ± 3.9 links                                 | 3.7 ± 4.6 links                                  | 4.5 ± 6.1 links   |

**Table 5. Articles with external links**

When examining multiple use, we also recorded which articles had any Internet links at all, and whether those links were in fact marked as clickable hyperlinks or not (they might have been just plain text, which the user couldn't click on). A total of 143 articles (38%) used one or more Internet references, and from those, only 114 (30%) had all of their links properly marked. Table 6 shows the situation broken down by country.

|              | Articles had Internet addresses in the references or bibliography | Signification groups *    | All of the Internet addresses in these articles were in fact marked (clickable) | Signification groups *    |
|--------------|---|---------------------------|---|---------------------------|
| <b>Total</b> | 143 (38%)   |                           | 114 (30%)   |                           |
| <b>ARG</b>   | 12 (23%)  | B C                       | 11 (22%)  | B C                       |
| <b>BRA</b>   | 36 (52%)  | A                         | 30 (43%)  | A                         |
| <b>CHL</b>   | 17 (47%)  | A                         | 12 (33%)  | A B                       |
| <b>COL</b>   | 15 (47%)  | A                         | 15 (47%)  | A                         |
| <b>CRI</b>   | 11 (61%)  | A                         | 9 (50%)   | A                         |
| <b>CUB</b>   | 7 (39%)   | A B                       | 5 (28%)   | A B C                     |
| <b>ECU</b>   | 0   | C                         | 0   | C                         |
| <b>MEX</b>   | 26 (29%)  | B C                       | 23 (26%)  | B C                       |
| <b>PER</b>   | 3 (33%)   | A B C                     | 2 (22%)   | A B C                     |
| <b>PRI</b>   | 7 (58%)   | A                         | 4 (33%)   | A B C                     |
| <b>URY</b>   | 4 (33%)   | A B C                     | 1 (8%)  | C                         |
| <b>VEN</b>   | 5 (24%)   | B C                       | 2 (9%)  | C                         |
|              |   | <b>p = 0.003 &lt; 0.1</b> |   | <b>p = 0.006 &lt; 0.1</b> |

**Table 6: Use of Internet references by authors, and correct marking of Internet references as hyperlinks**

|              | External links (from the references) connecting directly or indirectly to the item | Signification groups *    |
|--------------|--|---------------------------|
| <b>Total</b> | 98 articles (26%)<br>3.7 ± 4.6 links   |                           |
| <b>ARG</b>   | 10 articles (20%)<br>4.0 ± 3.2 links   | C                         |
| <b>BRA</b>   | 27 articles (39%)<br>3.2 ± 3.7 links   | C                         |
| <b>CHL</b>   | 13 articles (36%)<br>3.4 ± 4.6 links   | A B                       |
| <b>COL</b>   | 10 articles (31%)<br>3.1 ± 3.4 links   | C                         |
| <b>CRI</b>   | 8 articles (44%)<br>4.2 ± 3.7 links  | B C                       |
| <b>CUB</b>   | 2 articles (11%)<br>1.0 ± 0.0 links  | C                         |
| <b>ECU</b>   | 0  | B C                       |
| <b>MEX</b>   | 16 articles (18%)<br>4.0 ± 6.2 links   | C                         |
| <b>PER</b>   | 3 articles (33%)<br>11.0 ± 13.9 links  | A                         |
| <b>PRI</b>   | 5 articles (42%)<br>2.2 ± 0.8 links  | B C                       |
| <b>URY</b>   | 1 articles (8%)<br>6.0 ± 0.0 links   | B C                       |
| <b>VEN</b>   | 3 articles (14%)<br>3.3 ± 1.5 links  | C                         |
|              |  | <b>p = 0.098 &lt; 0.1</b> |

**Table 7: External links connecting directly or indirectly to the text of a reference item, broken down by country**

From all of the countries in table 6, Costa Rica, Puerto Rico, Brazil, Chile and Colombia show the richest use of Internet references by authors ( $p = 0.003 < 0.1$ ), but only Costa Rica, Colombia and Brazil match that a throughout use of link markedness ( $p = 0.006 < 0.1$ ), which only the case of Costa Rica reaches 50% of all articles having their links thoroughly marked as hyperlinks.

Table 7 describes the situation for “links leading directly or indirectly to the text”, where we found a significance by country: Chile and Peru appear to make the most use of links in the reference sections of their articles ( $p = 0.098 < 0.1$ ).

When broken down by subject we found that the total links from the reference (direct, indirect and abstracts) were significantly different. Table 8 shows that Natural and Exact Sciences and Agricultural Sciences journals used more links in average that the rest of the subjects ( $p = 0.04 < 0.1$ ).

|                                   | <b>External links connecting to the item or at least to its abstract</b> | <b>Signification groups *</b> |
|-----------------------------------|--|-------------------------------|
| <b>Total</b>                      | 98 articles (26%)<br>3.7 ± 4.6 links                                     |                               |
| <b>Arts and Humanities</b>        | 5 articles (14%)<br>2.2 ± 1.8 links                                      | C                             |
| <b>Agricultural Sciences</b>      | 8 articles (33%)<br>4.0 ± 3.5 links                                      | A B C                         |
| <b>Engineering</b>                | 10 articles (42%)<br>2.4 ± 1.6 links                                     | B C                           |
| <b>Natural and Exact Sciences</b> | 8 articles (27%)<br>10.5 ± 12.2 links                                    | A                             |
| <b>Medical Sciences</b>           | 14 articles (19%)<br>2.1 ± 2.0 links                                     | C                             |
| <b>Social Sciences</b>            | 47 articles (28%)<br>5.3 ± 6.3 links                                     | B                             |
| <b>Multidisciplinary</b>          | 6 articles (33%)<br>1.5 ± 0.8 links                                      | B C                           |
|                                   |  | <b>p = 0.04 &lt; 0.1</b>      |

**Table 8: External links connecting to the item or at least to its abstract, broken down by subject**

### 3.5. Interactivity

To analyze the possibilities offered by interactivity, we broke down the category in four different criteria: (1) presence of a contact form that a user can use to write to the editors, (2) presence of some means of communication between the reader and the author, or some expert in the field, (3) presence of some means of communication amongst the readers, and (4) use of alert features, such as e-mail subscriptions or RSS news feeds. The results for the 125 journals are summarized in Table 9.

We can see that Cuba, Brazil and Chile emerge as the more solid competitors in this area ( $p = 0.022 < 0.1$ ). Cuban journals make good use of rich websites to foster communication between the readers and the authors, mostly in the medical journals. Brazilian journals lead in offering alerts and “new issue warnings” to users (probably due to the common adoption of the OJS platform), and Chilean journals very frequently offer forms to the users (as opposed to simply e-mail addresses) to ask questions or relay opinions to the journal’s editors.

In total, we found that: (1) In the category of user-journal interaction, 17% of the journals offer contact forms, 5% offers ways to contact experts, and 17% offer alerts and news in some form. (2) In the category of user-user interaction, only 5% of the journals offer forums, discussion boards, or any other way for the readers to share information or reply to articles.

### 3.6 Latindex evaluation criteria

After calculating the points for the LATINDEX criteria, the following results emerged. The average LATINDEX score is 0.48 points, with 35% of the journals using metadata, 50% using search engines, and 58% using “added services”. Figure 1 describes what added services are more common in our sample, and Table 10 breaks down the LATINDEX score by country. Costa Rica and Brazil are the countries with the highest Latindex score (0.83 and 0.62 respectively;  $p = 0.07 < 0.1$ ).

| Country                   | Total journals | Crit.1 (Journals) | Crit.2 (Journals) | Crit.3 (Journals) | Crit.4 (Journals) | Average points | Signification groups |
|---------------------------|----------------|-------------------|-------------------|-------------------|-------------------|----------------|----------------------|
| <b>Total</b>              | 125            | 21 (17%)          | 6 (5%)            | 5 (4%)            | 21 (17%)          | 0,11           |                      |
| <b>ARG</b>                | 17             | 3 (17.6%)         | 0                 | 1 (5.9%)          | 5 (29.4%)         | 0,13           | B C D                |
| <b>BRA</b>                | 23             | 4 (17.4%)         | 0                 | 0                 | 11 (47.8%)        | 0,16           | B                    |
| <b>CHL</b>                | 12             | 5 (41.7%)         | 0                 | 0                 | 2 (16.7%)         | 0,15           | B C                  |
| <b>COL</b>                | 11             | 2 (18.2%)         | 0                 | 1 (9.1%)          | 0                 | 0,07           | C D E                |
| <b>CRI</b>                | 6              | 1 (16,7%)         | 1 (16.7%)         | 0                 | 0                 | 0,08           | B C D E              |
| <b>CUB</b>                | 6              | 4 (66.7%)         | 3 (50%)           | 0                 | 0                 | 0,29           | A                    |
| <b>ECU</b>                | 2              | 0                 | 0                 | 0                 | 0                 | 0              | B C D E              |
| <b>MEX</b>                | 30             | 1 (3,3%)          | 2 (6,7%)          | 2 (6.7%)          | 1 (3.3%)          | 0,05           | E                    |
| <b>PER</b>                | 3              | 1 (33.3%)         | 0                 | 0                 | 1 (33.3%)         | 0,17           | A B C D E            |
| <b>PRI</b>                | 4              | 0                 | 0                 | 0                 | 0                 | 0              | D E                  |
| <b>URY</b>                | 4              | 0                 | 0                 | 0                 | 1 (25%)           | 0,06           | B C D E              |
| <b>VEN</b>                | 7              | 0                 | 0                 | 1 (14.3%)         | 0                 | 0,04           | C D E                |
| <b>p = 0.022 &lt; 0,1</b> |                |                   |                   |                   |                   |                |                      |

**Table 9. Interactivity, broken down by country. Crit.1: Presence of contact form for user- journal interaction. Crit.2: Presence of some means of communication between the user and the author or some expert in the field. Crit. 3: Presence of some scheme of user-user communication. Crit.4: Use of alerts for the users.**

|              | Number of journals   |                           |                                | Signification groups *   |                          |                          |
|--------------|----------------------|---------------------------|--------------------------------|--------------------------|--------------------------|--------------------------|
|              | Latindex score (0-1) | Metadata usage (Journals) | Search engine usage (Journals) | Latindex score (0-1)     | Metadata usage           | Search engine usage      |
| <b>Total</b> | 0.48                 | 44 (35%)                  | 62 (50%)                       |                          |                          |                          |
| <b>ARG</b>   | 0.55                 | 9 (53%)                   | 7 (41%)                        | B C                      | A B                      | B                        |
| <b>BRA</b>   | 0.62                 | 10 (43%)                  | 16 (70%)                       | A B                      | B C                      | A                        |
| <b>CHL</b>   | 0.39                 | 3 (25%)                   | 6 (50%)                        | C                        | B C D                    | A B                      |
| <b>COL</b>   | 0.33                 | 1 (9%)                    | 4 (36%)                        | C                        | D                        | B                        |
| <b>CRI</b>   | 0.83                 | 5 (83%)                   | 5 (83%)                        | A                        | A                        | A                        |
| <b>CUB</b>   | 0.56                 | 3 (50%)                   | 3 (50%)                        | A B C                    | A B C                    | A B                      |
| <b>ECU</b>   | 0.17                 | 1 (50%)                   | 0                              | C                        | A B C D                  | B                        |
| <b>MEX</b>   | 0.38                 | 7 (23%)                   | 11 (37%)                       | C                        | C D                      | B                        |
| <b>PER</b>   | 0.56                 | 2 (67%)                   | 2 (67%)                        | A B C                    | A B C                    | A B                      |
| <b>PRI</b>   | 0.25                 | 0                         | 1 (25%)                        | C                        | D                        | B                        |
| <b>URY</b>   | 0.50                 | 2 (50%)                   | 1 (25%)                        | A B C                    | A B C D                  | B                        |
| <b>VEN</b>   | 0.43                 | 1 (14%)                   | 6 (86%)                        | B C                      | C D                      | A                        |
|              |                      |                           |                                | <b>p = 0.07 &lt; 0.1</b> | <b>p = 0.03 &lt; 0.1</b> | <b>p = 0.09 &lt; 0.1</b> |

**Tabla 10: LATINDEX evaluation criteria, broken down by country**

### 3.7 Comparison between Latin American and non-Latin American journals

For the comparison, we intentionally chose nine journals from Latin America and five from other parts of the world, based on their reputation for innovative use of Internet resources<sup>2</sup>. Within this small sample, we found that the non-Latin American options offer significantly more non-linearity ( $p = 0.005 < 0.1$ ), interactive features ( $p = 0.005 < 0.1$ ), use of multimedia ( $p = 0.04 < 0.1$ ) and linking to external documents ( $p = 0.007$

< 0.1). However, we did not find the two groups were significantly different in their LATINDEX score.

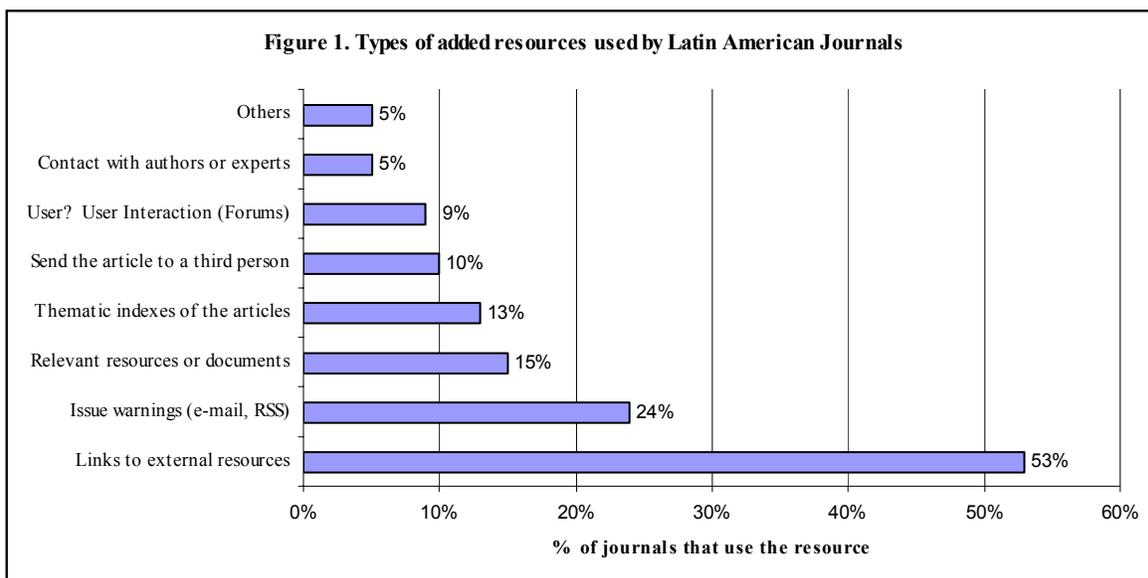


Figure 1. Types of added resources used by Latin American Journals

| Journals           | Interactivity      | Multimedia Use                   | LATINDEX score  |
|--------------------|--------------------|----------------------------------|---|
| Non-Latin American | 0.55 ± 0.41 pts.   | 0.40 ± 0.12 pts.                 | 0.87 ± 0.13 pts.  |
| Latin American     | 0.14 ± 0.18 pts.   | 0.05 ± 0.09 pts.                 | 0.67 ± 0.33 pts.  |
|                    | p = 0.005 < 0.1    | p = 0.04 < 0.1                   | p = 0.24 > 0.1  |
| Journals           | Navigational links | External links in the references | External links in the references (including links to abstracts) |
| Non-Latin American | 30.1 ± 5.2 links   | 4.2 ± 5.2 links                  | 49.6 ± 12.9 links   |
| Latin American     | 10.9 ± 18.2 links  | 1.3 ± 0.7 links                  | 4.0 ± 8.1 links   |
|                    | p = 0.005 < 0.1    | p = 0.02 < 0.1                   | p = 0.007 < 0.1   |

Table 11: Compared situation of a small simple of Latin American and Non-Latin American journals

#### 4. Discussion

The data obtained indicates that the use of Internet-related tools and technologies is not very widespread in the Latin American region. While there is a certain presence of multiple use within the articles (about 26% of all articles evaluated had HTML links in their references or bibliography), non-linearity and interaction are very seldom present in the journals, and the sight of multimedia functions in the journals is almost non-existent.

Only 13.6% of all articles are non-linear, with an average of 15.0 ± 15.2 navigational links for articles that are non-linear. Uruguay and Chile appear to stand out in this category (p = 0.01 < 0.1; see table 2), with 42% and 31% respectively of their articles having non-linear links. From the entire corpus, a mere 3.7% of all articles have links to references or bibliography items. This appears to be one of the least sought-after features across Latin American publishing. In both types of non-linear links (‘navigational’ and ‘directed to references’), the appearance of HTML publishing is determinant in raising consciousness and ultimately frequency in links (p d•0.002 < 0.1; see table 4). PDF-only publishing might be keeping the editors from fathoming the possibilities of non-linearity, which might be the cause for these results.

Multimedia was the least frequent of all characteristics. Only 3 journals have audio features, and only 4 journals have some form of video. Three of the more noteworthy cases were: (i) *Actualidades Investigativas en Educación* (Costa Rica), where Quicktime audio and video is used in one of its articles. (ii) *La pintura mural prehispánica en México* (Mexico), that offers online Flash videos produced by its parent research unit. (iii) *Revista de Enfermedades Infecciosas en Pediatría* (Mexico), where audio interviews present its authors and other researchers discussing current issues.

Multiple use was the characteristic that fared better in our corpus. About a quarter of the articles (26%) had links that departed from the references, and landed on either the document, or on a page with the abstract of the original article. Mayernik only considered direct links, meaning links that landed on the text of the document cited. In our corpus, 22% of the articles had this kind of direct links in their reference sections, and 14% of the articles had such links within the body of the text. In total, 38% of the articles did cite Internet references, with Costa Rica, Puerto Rico, Brazil, Chile and Colombia as the locations where these references are most common among authors ( $p = 0.003 < 0.1$ ; see table 6), and Chile and Peru as the countries where those references will be more likely to include a link leading directly to (or within 3 clicks of) the cited text ( $p = 0.098 < 0.1$ ; see table 7). The fields of Natural Sciences and Agricultural Sciences presented the highest frequency of links in the references ( $p = 0.04 < 0.1$ ; see table 8), which might be influenced by the situation described by Cronin [13]: “publishing practices differ; for example, disciplines such as molecular biology follow a pattern characterized by a large number of relatively short papers with joint authorship, frequently appearing in highly cited journals”.

While looking into the multiple use functionality, we discovered a widespread and potentially seriously problem of mismarking in the links leading to external documents. In our sample, only 51% of all potential links were well marked (leading to any Internet page at all when clicked on). From the remaining 49%, only 10% were broken links, 15% were completely unmarked links (only appearing as text), and a full 24% were misspelled or incomplete. The most common problem occurred when marking the reference items. Since URL addresses must fit within the layout page, the longer links get “broken in two”, so that the two parts are sitting on different lines. The paragraph looks very orderly, but the automatic marking cannot recognize the second part of the address, and marks only the first section. When this happens, the address gets “cut off in the middle”, and the browser can’t possibly find the right page. While the problem of link-morbidity in scholarly writing still needs to be addressed, we believe this apparently simple problem should also be taken into account.

In the interactivity section, the most common forms of interaction offered by the journals were user!journal in the form of question forms (17% of journals) and new issue warnings (17% of journals). Some journals however (5%) had ways to provide user!user interaction, through user forums and systems of response to published articles, so that the readers could participate in the discussion. E-mail only contact with the journal continues to be the norm, with Cuba as the most salient exception for the user interaction available in its medical journals ( $p = 0.02 < 0.1$ ; see table 9).

As for the Latindex characteristics, about 35% of the journals have metadata within their pages, and 50% offer search engines to their users. Costa Rica and Brazil get the most points across the three Latindex categories ( $p = 0.07 < 0.1$ ; see table 10): 83% of Costa Rican journals offer metadata in their websites, and 83% uses search engines for the sites’ contents. The average LATINDEX grade for Costa Rican journals was 0.83, while the average for Brazilian journals was 0.62.

When comparing the results of the non-Latin American journals with the Latin American ones, the differences are quite obvious. Every single balance tips in favor of the non-Latin American journals (and not only in quantity; the quality of the navigational linking for example is much noticeable). The only exception was in the case of LATINDEX characteristics, where there is no significant difference.

## 5. Conclusions

At this point, we can conclude that the situation of the average the scientific electronic journals from Latin America does not really differ from that one studied by Mayernik and the results obtained by Marcondes et al. [7]; that is, that the journals from this part of the world, “as many international e-journals, are still designed based on paper journals models. They incorporate few of those technological facilities”. Very few journals use formats and techniques that can fully take advantage of the possibilities offered by Internet tools. Many journals take a great deal of care to offer a presentable “cover page”, with a very flexible and non-linear entry page. However, those efforts wilt as the user approaches the article pages, until the article’s text becomes a copy of the original printed format.

Traditionally, editors have thought that their articles have only one audience: human beings. An attractive presentation will surely play a role in a diligent editor’s duty. However, a good visual layout will be impenetrable to what has become a second audience for the articles: computers systems such as robots and spiders that crawl the article in search of usable links, hoping to weave valuable connections between science web pages throughout the world. These two audiences (humans and web-exploration software) complement each other, and both beg attention from the editor. Creating awareness about this problem might be the only way to go.

While the present situation in the journals of Latin America is not the best of all possible worlds, the adoption of basic Internet tools such as metadata and search engines is in itself no small feat. The LATININDEX network of associates constantly monitors the use of these features in each country, and has campaigned among local editors to create awareness about them, which might have helped reach the results that we see today. In spite of the low scores in the Mayernik categories, there was no significant difference in the use of metadata and search engines between the “top Latin American journals” and the “top non-Latin American journals” we studied in table 11. Superficial as this comparison might be, it does speak of the achievements that electronic publishing has reached in this group of countries. In countries like Chile, Costa Rica, Colombia, Brazil and Mexico, we found examples of good journals that are well prepared to compete in the global arena.

Five countries stand out from the corpus: Brazil, Chile, Costa Rica and Cuba (for their relatively good scores in all of the characteristics), and Mexico (for its incorporation of multimedia into their publishing practices). Every country has its peculiarities. As a part of the informal BRIC bloc, Brazil has been hard pressed to improve the quality of their scientific output. Both Chile and Costa Rica fare well in the Global Competitiveness Report [14] (first and fifth place respectively among countries and territories in Latin America) and the Human Development Index [15] (second and fourth place respectively). Cuba is reputed in the region for “good old resourcefulness” in the face of economic difficulties, but also for a very strict and vertical research culture. Mexico’s UNAM is the only university in the region in the top 200 universities of the QS Ranking, followed within the top 250 by Chile’s Pontificia Universidad Católica [16]. In spite of these varying conditions, the one thread that places these countries together is that they have the largest investment in Research and Development in the region when compared to their GNP: Brasil, 0.83%; Chile, 0.68%; Cuba, 0.56%; Mexico, 0.46%; and Costa Rica, 0.41% [17]. This has allowed them to use much needed resources in raising awareness about their scientific communication processes, a fact that appears to be reflected in the data we have obtained.

Determining the exact extent to which funding, funding models, and the availability of materials at the individual journal level truly influences the results of this investigation is a question that calls for future study. Marcondes et.al.’s [7] suggestion of “lack of professionalism” is certainly a strong statement that has little or nothing to do with funds; Costa, Silva y Costa [18] point at the direction of lack of computer alphabetization as the culprit of the situation. Some editors might be considering that “just being on the Internet” is added value enough and that there is no need to improve or work on that online presence. Yet

another possibility is that they consider the addition of links might be “baffling” to the user, where the “user” is still the narrow vision of humans as the only consumers of their information. The situation hints a complex interaction between availability of funds and willingness to ‘think outside the box’, and more research is needed to understand the attitudes of editors towards electronic publishing.

## 6. Acknowledgements

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## 7. Notes

<sup>1</sup> Further examples include the Mexican E-Journal at UNAM and the Costa Rican Latindex-UCR at University of Costa Rica.

<sup>2</sup> There is indeed overlap between the “added services” category in LATINDEX, and the interactivity characteristic of Mayernik. Figure 1 describes the specific added services found in the sample, and can be contrasted to Table 9 for differences between the two.

<sup>3</sup> In this case, we asked to LATINDEX partners who have the biggest groups of online journals in the Directory. From them, we got three different answers: Mexico, Colombia and Costa Rica, but our experience begged us to also include journals from Chile and Brazil. We chose the following non-Latin American journals: *Journal of Electronic Publishing*, *British Medical Journal*, *Behavioral and Brain Sciences*, *PLoS Medicine and CTheory*. As for the Latin American journals, we selected: *Online Brazilian Journal of Nursing*, *Revista Eletrônica de Estudos Hegelianos*, *Colombia Médica*, *Livestock Research For Rural Development*, *Revista E-mercatoria*, *e-Gnosis*, *Aleph Zero*, *Cinta de Moebio* and the *Electronic Journal of Biotechnology*.

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## 8. Appendix 1: Journals included in the study

- Argentina: Archivos argentinos de alergia e inmunología clínica, AdVersus, Biocell, Contabilidad y auditoría, Dermatología Argentina, Equipo Federal del Trabajo, Foro Iberoamericano sobre Estrategias de Comunicación (FISEC), Hologramática, Journal of Applied Economics, Journal of Computer Science and Technology, Psikeba, Rev. Argentina de Lingüística, Revista de Ciencias Sociales, Rev. De Investigaciones Agropecuarias, Telondefondo, Universitas, Urbe et Ius.
- Brazil: Afro Asia, Boletim do Instituto de Pesca, Brazilian Administration Review, Brazilian Journal of Biomotricity, Caderno espaço feminino, Caderno Virtual de Turismo, Contingentia, Data Grama Zero, Economia e Energia, Educação Temática Digital, Engenharia Ambiental, Hegemonia, Klepsidra, Online Brazilian Journal of Nursing, Relações públicas em revista, Revista brasileira de educação médica, Revista Brasileira de Zoologia, Revista de Estudos da Religião, Revista de Gestão da Tecnologia e Sistemas de Informação, Revista Eletrônica de Estudos Hegelianos, Revista Expectativa, Revista Matéria, Semina.
- Chile Agenda Pública, Ciencia y Trabajo, Cinta de Moebio, Cuadernos de Economía, El Vigía (Santiago), Electronic Journal of Biotechnology, Journal of Technology Management and Innovation, Monografías electrónicas de patología veterinaria, Política Criminal, Rev. Chilena de Ciencia de la Computación, Rev. Chilena de Semiótica, Revista Universitaria.
- Colombia Acta Biológica Colombiana, Colombia Médica, Cuadernos de Administración, Earth Sciences Research Journal, Livestock Research For Rural Development, Nómadas, Rev. Ciencias Humanas, Rev. Latinoamericana de Ciencias Sociales, Niñez y Juventud, Revista EIA Ingeniería Antioquía, Revista E-mercatoria, Revista Escuela Colombiana de Medicina - ECM.
- Costa Rica Actualidades Investigativas en Educación, Diálogos, MHSalud, Población y Salud en Mesoamérica, Reflexiones, Revista de Derecho Electoral.
- Cuba ACIMED, Fitosanidad, Multimed, Revista cubana de investigaciones biomédicas, Revista Cubana de Obstetricia y Ginecología, Revista cubana de pediatría.
- Ecuador Gaceta Dermatológica Ecuatoriana, Universidad-Verdad
- Mexico Acta Médica Grupo Ángeles, Alegatos, Aleph Zero Anales del I.Biología, Serie Zoología, Anuario Mexicano de Derecho Internacional, Archivos Hispanoamericanos de Sexología, Biblioteca Universitaria, Buenaval, Computación y Sistemas, Cuadernos de Psicoanálisis, Dugesiana, Educar, e-Gnosis, El Psicólogo Anahuac, Hitos de Ciencias Económico Administrativas, InFÁRMate, Investigación Bibliotecológica, Journal of Applied Research and Technology, La pintura mural prehispánica en México, Los amantes de Sofía, Mensaje bioquímico, Nueva Antropología, Redes Música, Rev. Ciencia Veterinaria, Revista Biomédica, Revista de Enfermedades Infecciosas en Pediatría, Revista de la Educación Superior, Revista del Instituto Nacional de Cancerología, Revista Fractal, Revista Mexicana de Física.
- Peru Biblios, Diagnóstico, Escritura y Pensamiento
- Puerto Rico Ceteris Paribus, El Amauta, Rev. Int. Desastres Naturales, Infraestructura Civil, Videoenlace Interactivo.

- Uruguay Actas de Fisiología, Boletín Cinterfor, Boletín del Inst. de Inv. Pesqueras, Galileo.
- Venezuela Acción Pedagógica, Boletín Antropológico, Cayapa, Música en clave, Postgrado, Rev. Ingeniería UC, Revista de la Sociedad Médico-Quirúrgica del Hospital de Emergencia Pérez de León.